

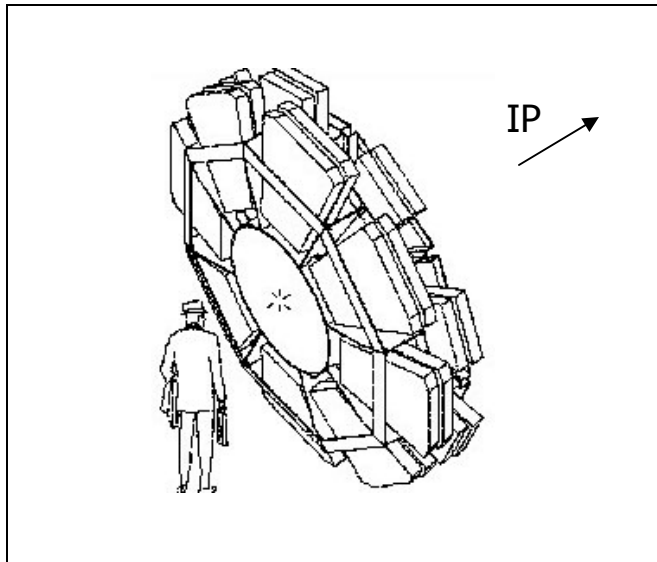
CSC electronics production readiness review -- Overview

P. O'Connor, BNL

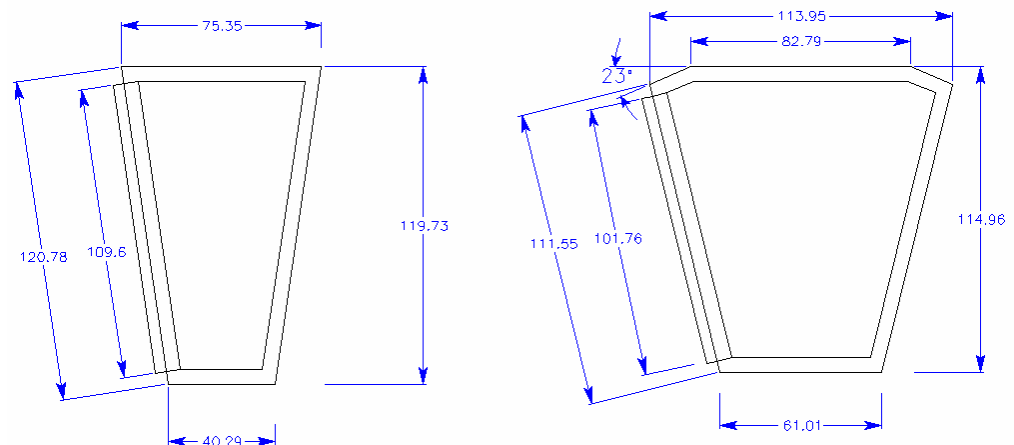
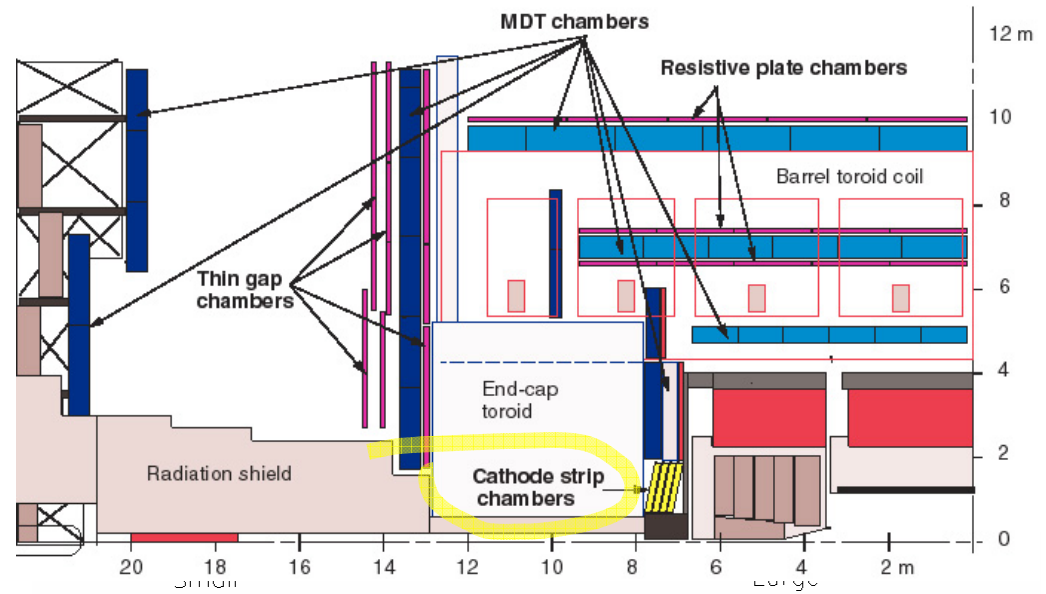
Outline

- Background
- Prior work
- Deliverables
- Schedule and Plans

CSCs are the forward precision muon system of ATLAS

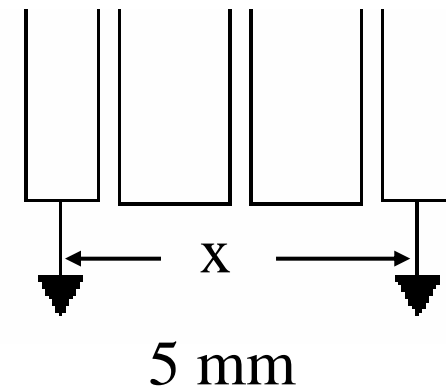
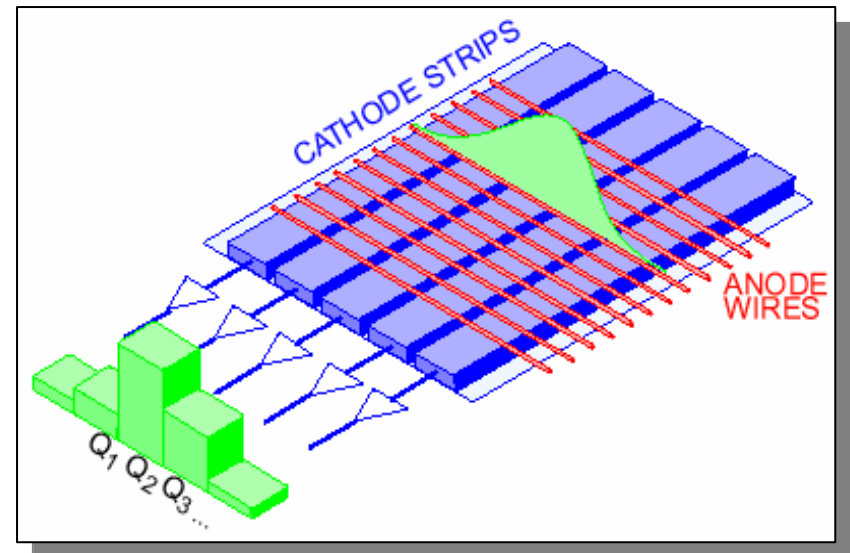


32 four-layer chambers
 $2.0 < |\eta| < 2.7$
 $|Z| \sim 7\text{m}, 1 < r < 2\text{m}$
4 gas gaps per chamber
31,000 channels

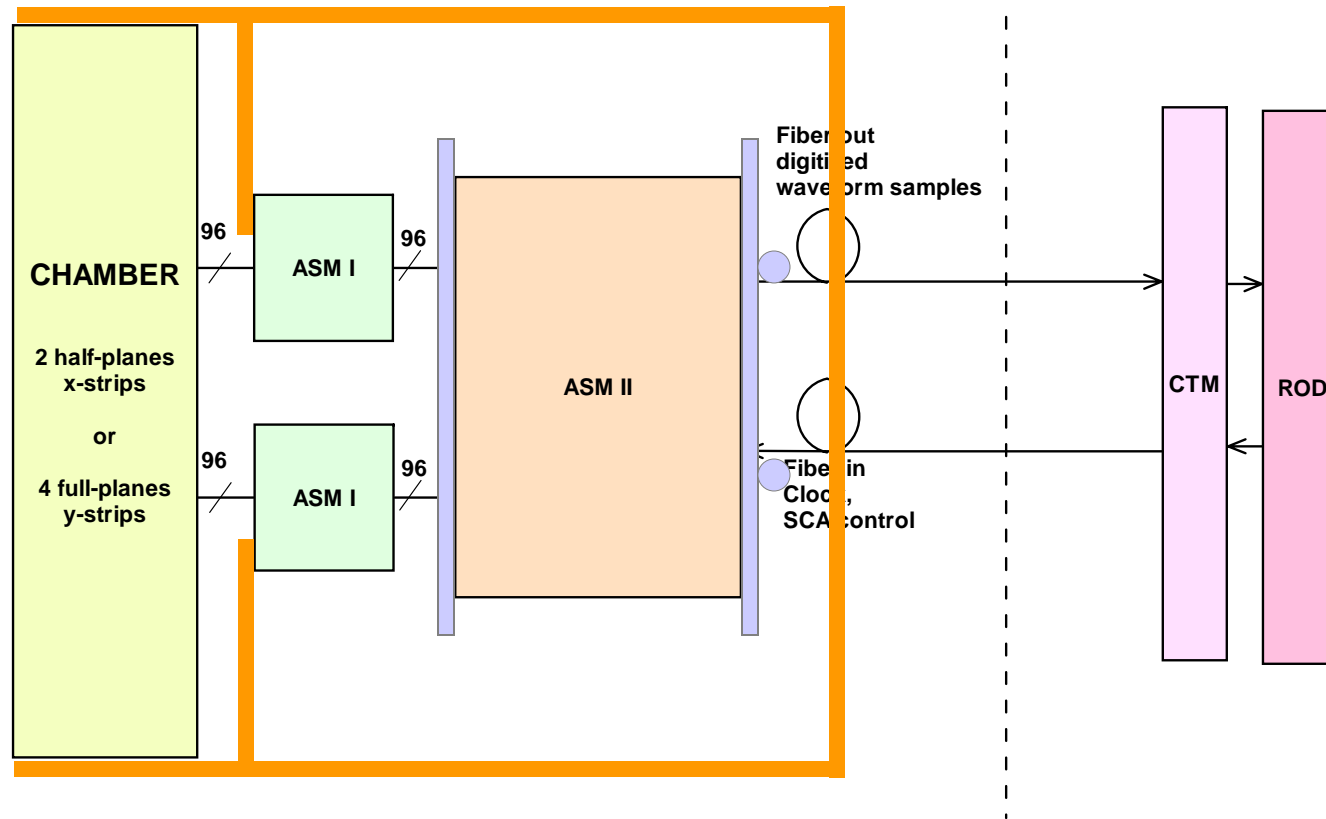


Principle of operation

- Determine muon position by interpolating the charge on 3 to 5 adjacent cathode strips
- Precision (x-) strip pitch ~ 5 mm
- Measure $Q_1, Q_2, Q_3 \dots$ with 150:1 SNR to get $\sigma_x \sim 80 \mu\text{m}$
- Second set of y-strips measure transverse coordinate to ~ 1 cm
- Rate up to 650 kHz/strip
- Timing to within one beam crossing
- High radiation tolerance
- Area and power constraints



Electronics signal chain

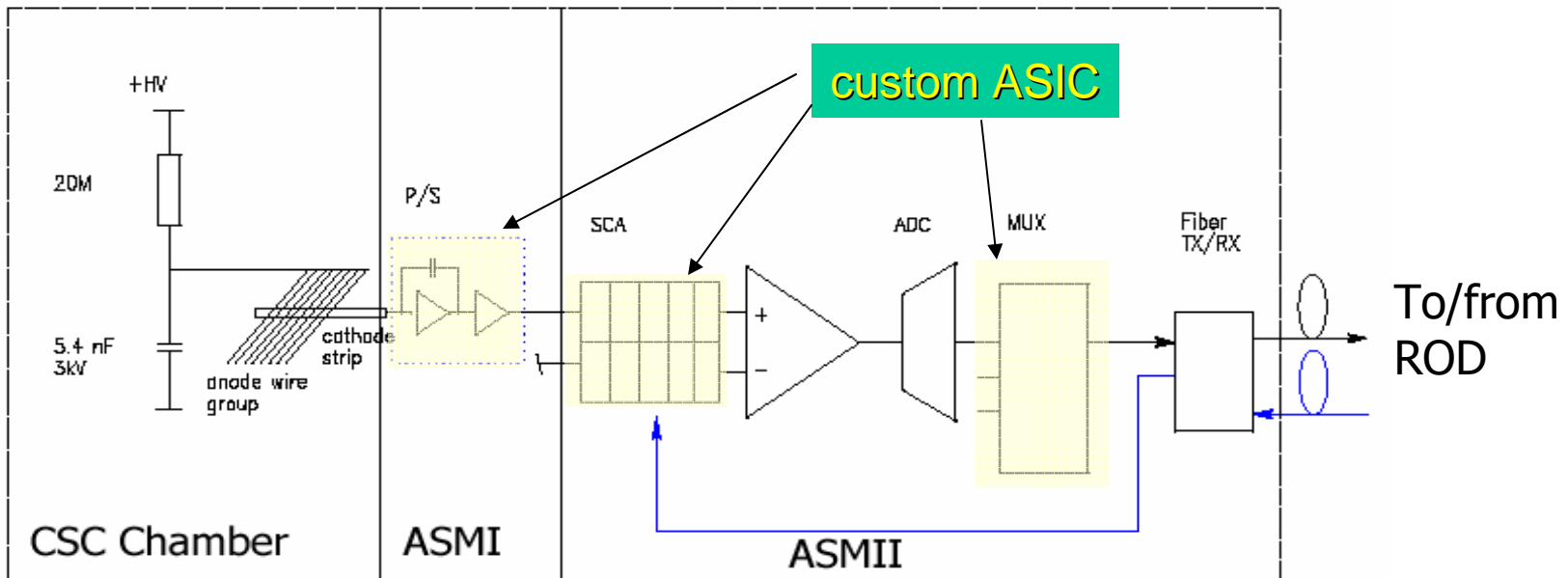


Electronics deliverables

• ASM1	320 boards
• ASM2	160 boards
• ROD	16 boards
• x-cooling and shielding hardware	64 assemblies
• y-cooling and shielding hardware	32 assemblies

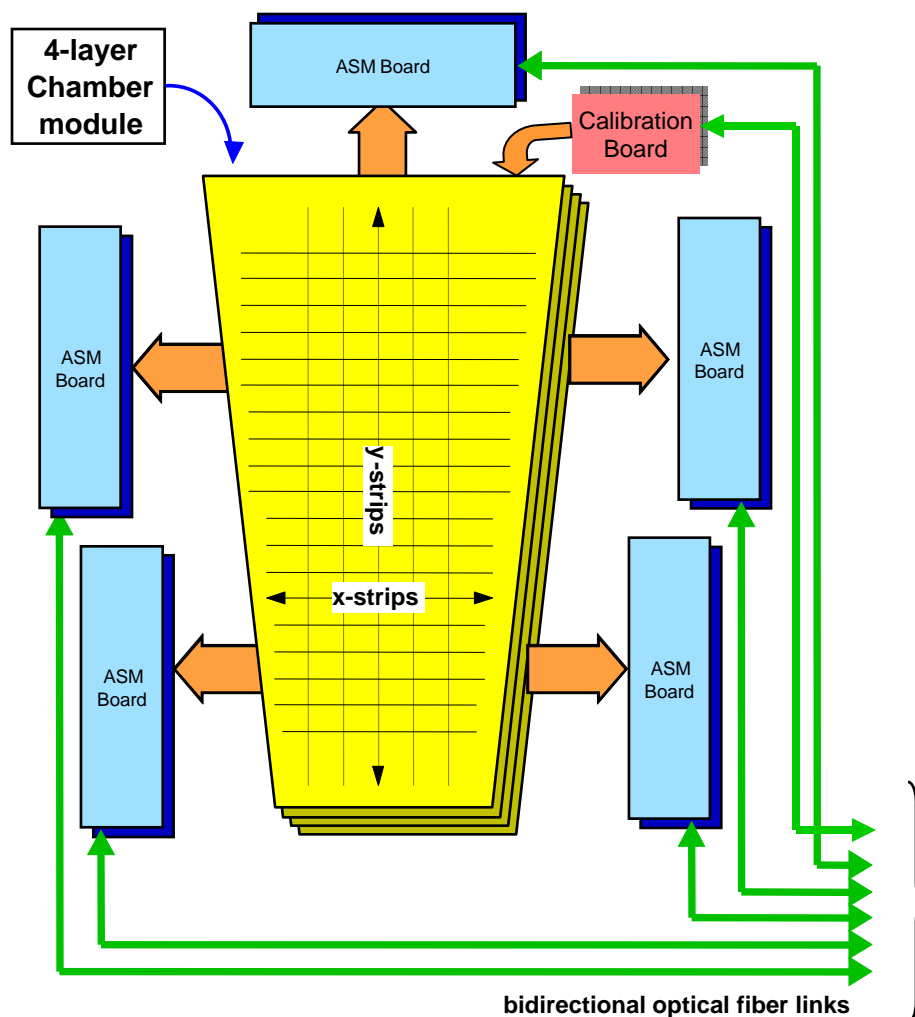
We are asking for a go-ahead to begin production of these items.

On-detector electronics chain



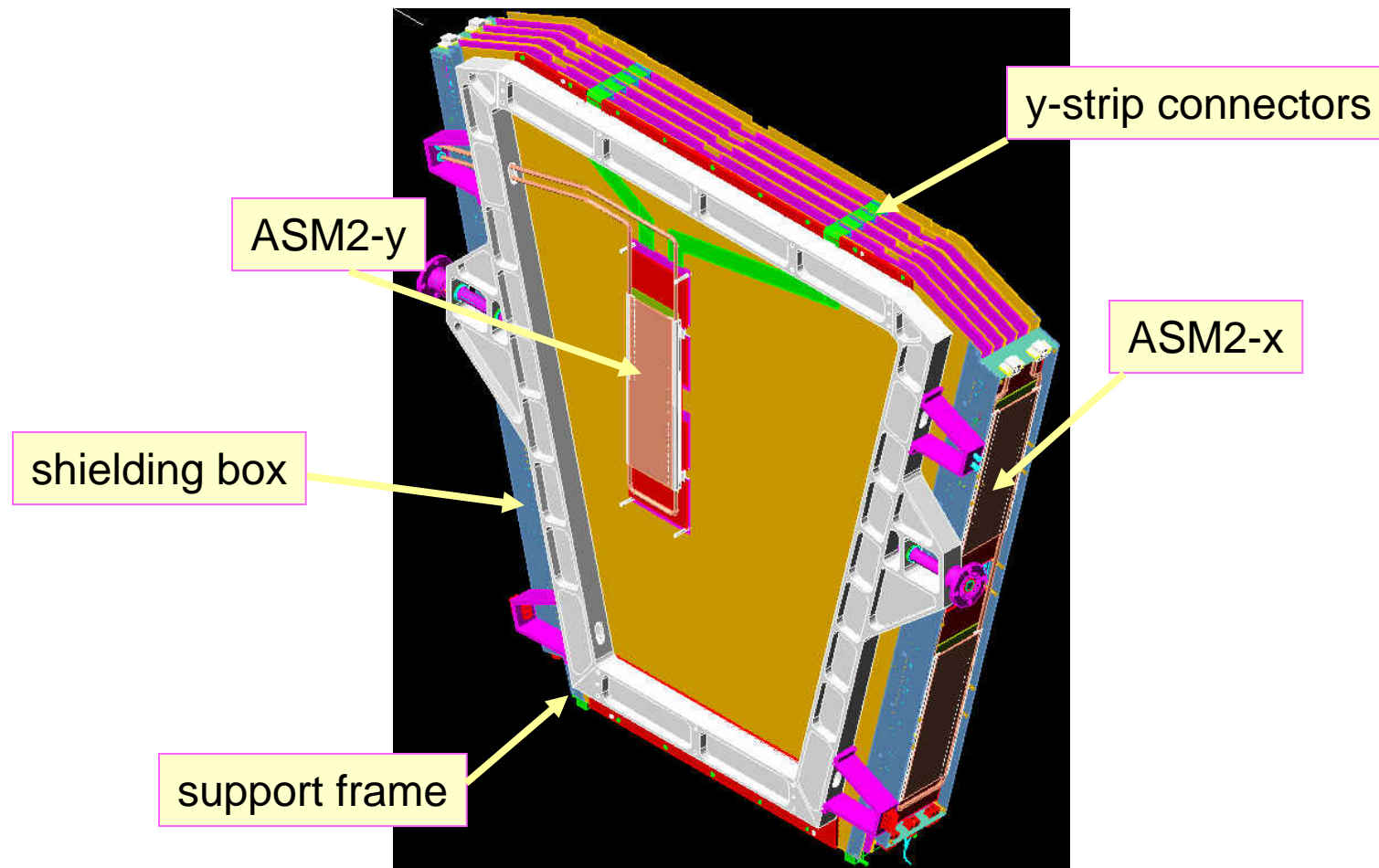
- **A**mplification, **S**ampling, digitization, and **M**ultiplexing into optical fiber
- bipolar shaping, 70 ns peaking time
- 50 ns sampling
- 10 bit dynamic range
- 3 custom, radiation-tolerant ASICs

On-detector electronics organization – one chamber

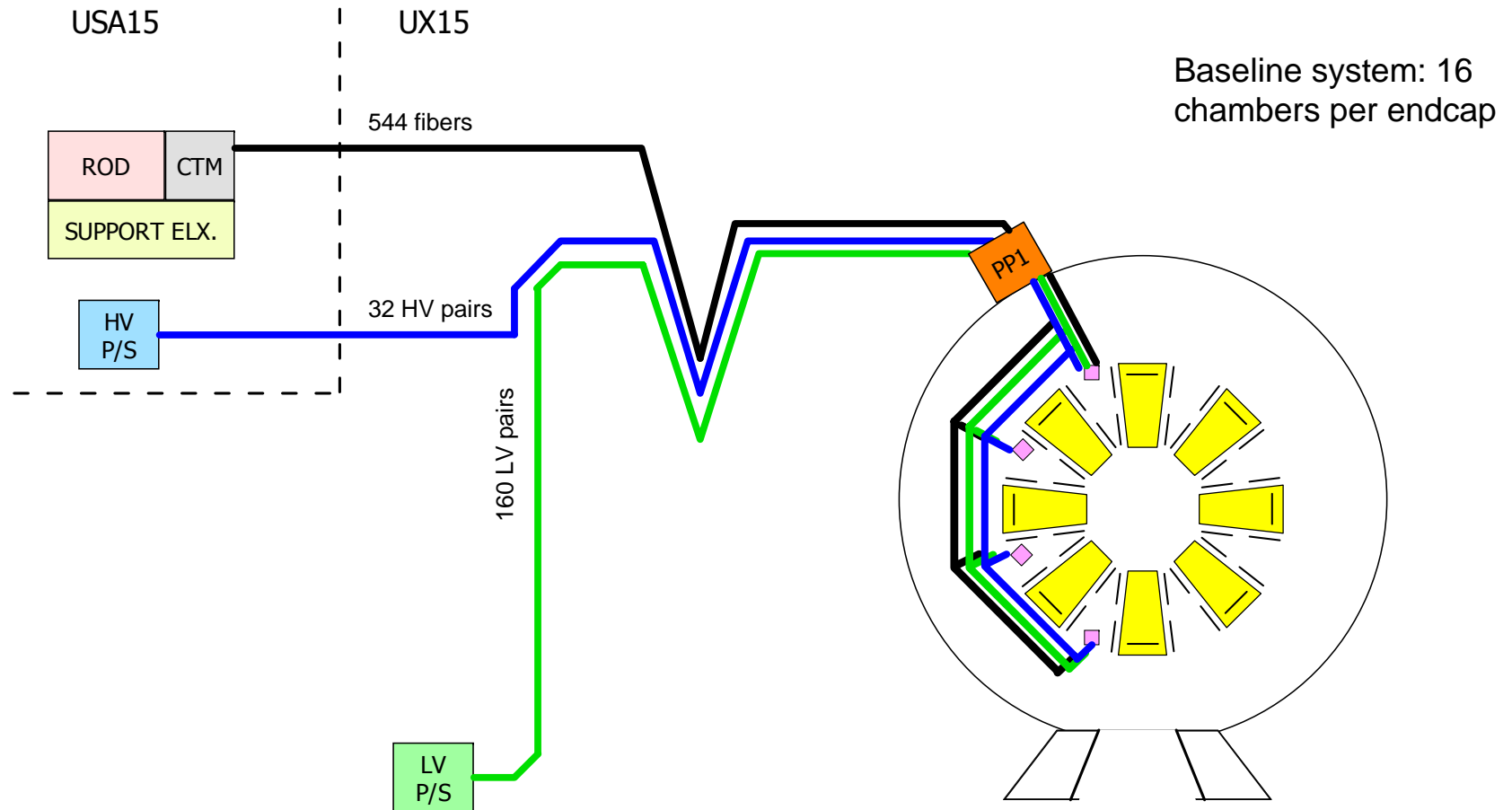


- 960 channels
- 4 ASM-x
- 1 ASM-y
- 1 calibration board (U. of Arizona)
- 17 optical links:
 - 10 data links
 - 5 control links
 - 2 calibration links
- 5 low-voltage cable pairs
- ≈ 300 W dissipation

Model showing chamber with support frame, electronics, cooling and shielding hardware

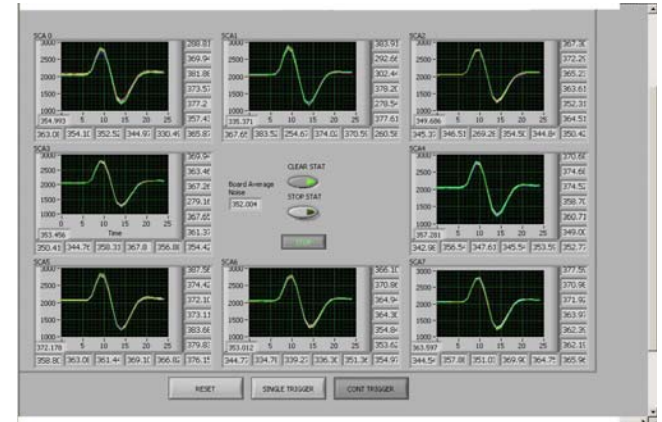


CSC electronics layout in cavern



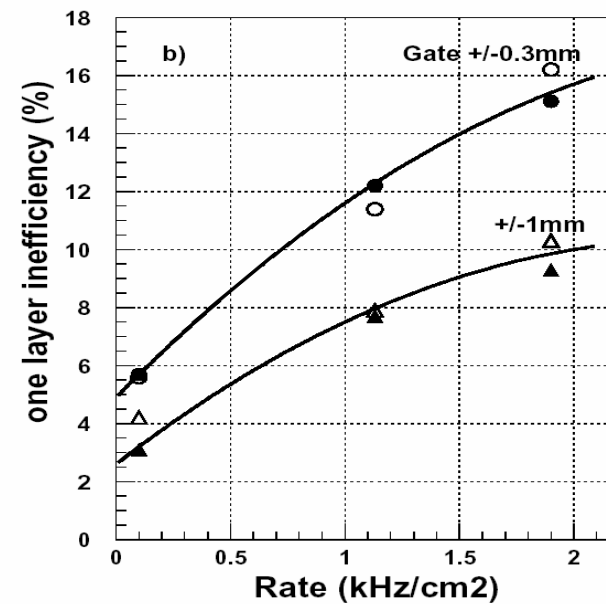
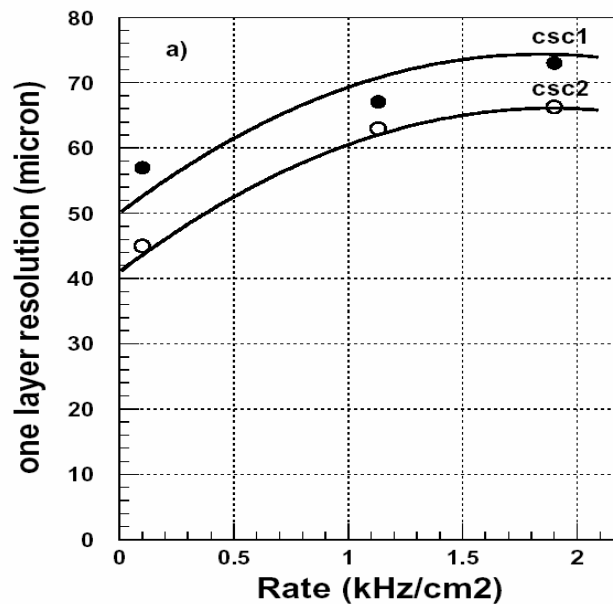
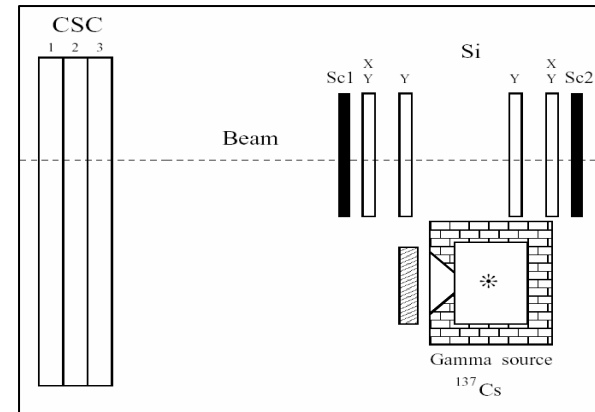
Milestones

- Test beam 10/99 with high background
- ASIC Radiation Tolerance testing
- ASIC procurement
- ASIC production test fixtures and software
- Mini-DAQ system (PCI card + Labview real-time signal display)
- Electronics cooling prototype
- Fully instrumented chamber
- Integration of complete electronics chain, chamber → ROD
- Stand-alone DAQ and run control software
- Cosmic ray test with full electronics: verified
 - *noise in realistic environment*
 - *full-rate data acquisition to 100 kHz*
 - *overall robustness*



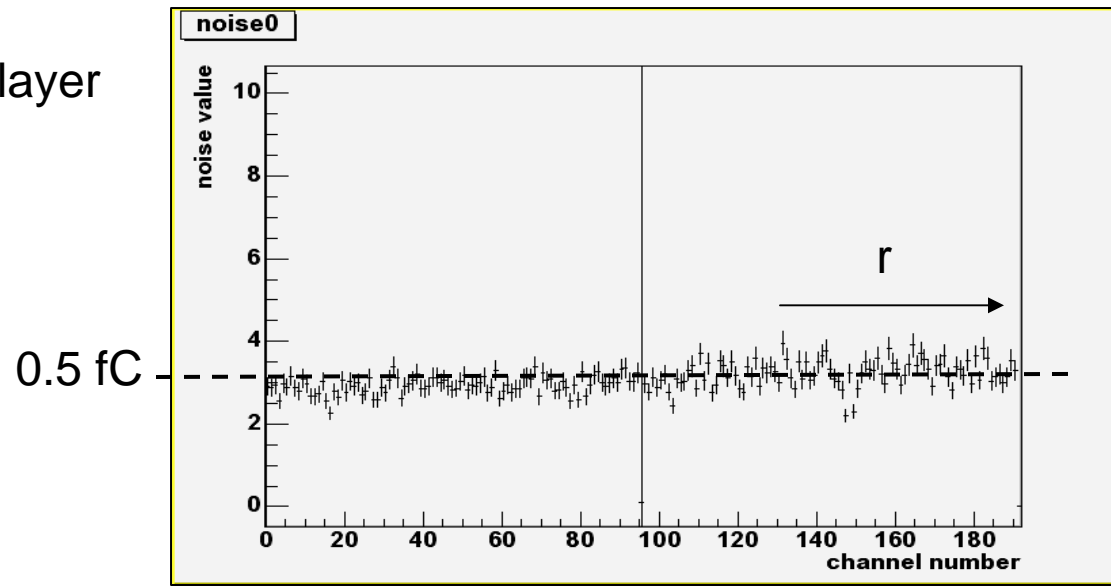
10/99 beam test results

- Used all signal-chain ASICs
- Muon position resolution measured using Si telescope + three chamber layers
- Position resolution and efficiency in presence of high background

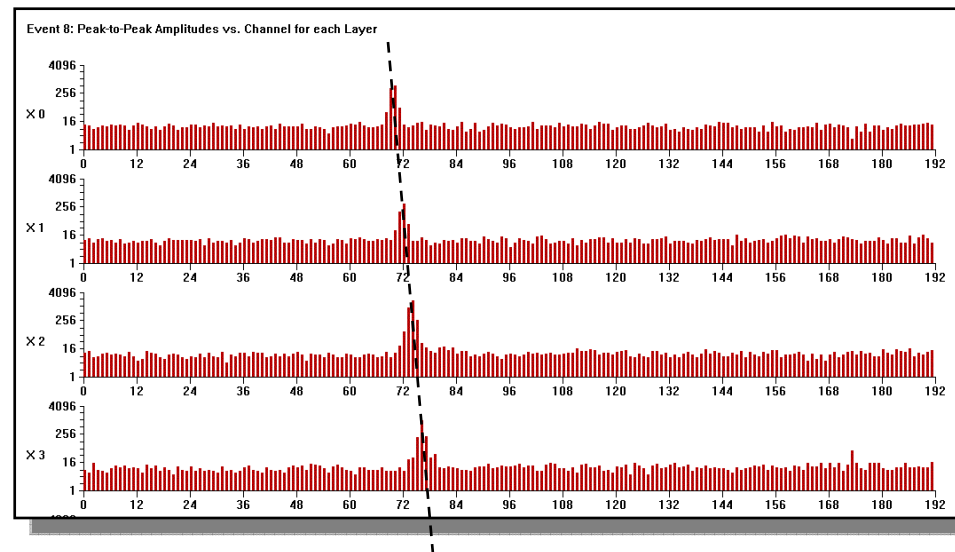


2004 System Integration Test

Noise distribution in one layer



Cosmic muon track



Production plan

- Procure PCBs and components
- Complete testing of custom ASICs (P/S and MUX)
- Prepare component kits for assembler
- Contract assembly of PCBs
- Receive assembled boards
- Inspect, barcode and initial test

 18 weeks

- Burn-in (ASM1 & ASM2)
- Final test
- (Rework as necessary)

 30 weeks

- Integrate onto CSC chambers (ASM1 & ASM2), ship to CERN